Control Number 10/712,949 (filed 11/13/2003)
Art Unit: 1764

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REMARKS

This Amendment is respectfully submitted to place subject divisional Application in condition for allowance. In particular, Claims 21 to 28 have been canceled without prejudice, and replacement claims have been added to more particularly point out and distinctly claim the subject matter which applicants regard as the invention, and to comply with requirements under 35 U.S.C. § 112. In particular, new Claims 31 to 39 are based, respectively, on Claims 21, 11, 15, 28, 22, 23, and 25 to 27.

New Claim 31 is directed to Applicants' novel, integrated, process that includes:

(a) reacting a petroleum distillate consisting essentially of material boiling between about 50° C. and about 425° C. comprising a mixture of sulfur-containing, nitrogen-containing and other organic compounds derived from natural petroleum with a source of hydrogen at hydrogenation conditions in the presence of a hydrogenation catalyst to assist by hydrogenation removal of sulfur and/or nitrogen from hydrotreated distillate;

(b) partitioning by distillation the hydrotreated distillate to provide at least one low-boiling organic part consisting of a sulfur-lean, mono-aromatic-rich fraction collected below a temperature in the range from 260° C. to 300° C., and a high-boiling organic part consisting of a sulfur-rich, mono-aromatic-lean fraction;

(c) contacting a gaseous source of dioxygen with at least a portion of the low-boiling organic part in a liquid reaction medium containing a particulate, heterogeneous oxygenation catalyst system which exhibits a capability to enhance the incorporation of oxygen into a mixture of liquid organic compounds and comprises one or more catalyst metal selected from the group consisting of chromium, molybdenum, bismuth, manganese, iron, and platinum, employed as metal oxide, mixed metal oxide, and/or basic salts of the metal or mixed metal oxide, while maintaining the reaction medium substantially free of halogen and/or halogen-containing compounds, to form a liquid mixture comprising hydrocarbons, oxygenated organic compounds, water of reaction, and acidic co-products, such that the oxygenation of the hydrocarbon portion of the liquid mixture is more than 1 percent by weight;

(d) separating from the mixture at least a first organic liquid of low density comprising hydrocarbons, oxygenated sulfur-containing, oxygenated nitrogen-containing and other oxygenated organic compounds and acidic co-products and at least portions of the catalyst metal, water of reaction and acidic co-products, and a second separated liquid which is an aqueous solution containing at least a portion of the oxidized sulfur-containing and/or nitrogen-containing organic compounds; and

(e) recovering from the first organic liquid a low-boiling oxygenated product having a low content of nitrogen, acidic co-products and a sulfur content of no more than 15 ppm .

Support for Claim 31 is found in the Specification and canceled Claim 21.

Claim Rejections - 35 U.S.C. § 112

In outstanding Office Action, Claims 21 to 28 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject mater which applicant regards as the invention.

Examiner Nguyen avers that the expression recovering a low-boiling oxygenated product having a low content of nitrogen, acid co-product" in the last 2 lined of claim 21, renders the claims indefinite because in is unclear if the low-boiling oxygenated product comes for the first organic liquid or from the second separated liquid. Applicants respectfully traverse this rejection.

Claim 31 and therefore dependent claims 32 to 39, all claims now presented, recite "recovering from the first organic liquid a low-boiling oxygenated product having a low content of nitrogen, acidic co-products and a sulfur content of no more than 15 ppm."

Applicant respectfully requests Examiner Nguyen to withdraw his 112 rejections, and pass subject application for allowance.

Claim Rejections - 35 U.S.C. § 103(a)

In outstanding Office Action, Claims 21 to 28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Brownawell et al. (EP-0 252 606) in view of Schultz

et al. (US 2,365,220) and Farkas et al. (US 2,472,152). Applicants respectfully traverse these rejections.

The Brownawell et al. reference of record describes a process said to increase the cetane number of a middle distillate fuel fraction by using one or more non-oxide catalytic metals to selectively oxidize benzylic carbon atoms present in the fuel to ketones. Preferably, Brownawell et al. states, the non-oxide catalyst will be one or more oil or water soluble compounds. On the other hand, the non-oxide catalytic metal compound may be insoluble in both oil and water. In non-preferred cases, the insoluble, non-oxide catalytic metal compound may be in a bulk form or supported on a suitable support material (page 5, lines 27 to 32). The Brownawell et al. reference of record does not define or illustrate the meaning of the term "suitable support material." All of the working examples in the reference of record use oil soluble metal salts; copper sulfate pentrahydrate in Examples 1 to 3, and cobalt naphthenate (6% Co) catalyst solution in Examples 4 to 6.

In contrast, instant claims recite as critical elements of Applicants' novel process the use of a liquid reaction medium containing a **particulate**, heterogeneous oxygenation catalyst system which comprises one or more catalyst metal selected from the group consisting of chromium, molybdenum, bismuth, manganese, iron and platinum employed as metal oxide, mixed metal oxide, and/or basic salts of the metal or mixed metal oxide, while maintaining the reaction medium substantially free of halogen and/or halogen-containing compounds. Claim 31 recites recovery of a low-boiling oxygenated product having a low content of nitrogen, acidic co-products and a sulfur content of no more than 15 ppm. Analyses of Applicants' organic liquid of low density determined sulfur contents below 10 ppm, and even as low as 6 ppm (see Example 7).

As noted by Examiner, example 1 in the Brownawell et al. reference of record shows that sulfur content is decreased form 0.74 weight percent to 0.42 weight percent (4,200 ppm). By contrast instant claims are directed to a product with a sulfur content of no more than 15 ppm. It is the position of Applicants that processes described in the

EP reference are different in kind, not merely degree, from Applicants' novel processes.

As Examiner notes, Brownawell et al. (the EP reference) does not disclose partitioning by distillation the hydrotreated distillate to provide at least one low-boiling organic part consisting of a sulfur-lean, mono-aromatic-rich fraction collected below a temperature in the range from 260° C. to 300° C., and a high-boiling organic part consisting of a sulfur-rich, mono-aromatic-lean fraction. Applicants believe it is important to understand that collecting the low-boiling organic part (consisting of a sulfur-lean, mono-aromatic-rich fraction) below a temperature in the range from 260° C. to 300° C is a critical element of their novel invention. In particular this low-boiling fraction has a suitably low boiling end-point such that when this fraction is oxygenated, the resulting increase in the final boiling point is no higher than the maximum end-point of the refinery fuel specification. At the same time Applicants' critical cut-point provides a low-boiling fraction that is both sulfur-lean, mono-aromatic-rich.

Contrary to the position of Examiner, Applicants believe, because the step of partitioning by distillation the hydrotreated distillate in combination with the step of catalytic oxidation of the low-boiling portion cooperate to thereby achieve three necessary objectives, that their critical end-point would NOT have been obvious to one having ordinary skill in the relevant art at the time the invention was made.

The Schultz et al. reference of record is directed to attainment of minimum engine knocking by using a Diesel fuel comprising organic peroxides formed by non-catalytic contact with air, oxygen or an oxygen-carrying gas at 290 to 300° F. Thereafter, "the oil was washed with water to remove calcium salts of organic acids (by partial solution and suspension in the water) and free acids were then removed by scrubbing with 5% caustic soda solution in very small excess only, after which the scrubbed oil was again water-washed" (Schultz et al., page 2, right col., lines 1 to 18). Without this neutralization of acidic co-products, the peroxides formed, which are unstable in the presence of the free acids, would go away before the fuel could be used.

While the Schultz et al. reference of record suggests need for neutralizing acids in hydrocarbon effluent from non-catalytic oxidation forming organic peroxides,

Schultz et al does not disclose or suggest how to avoid the big problem of emulsion formation in scrubbing with caustic soda solution. In particular, Schultz et al does not disclose use of a neutralizing agent that comprises bicarbonate selected from the group as recited in Claim 32.

Farkas et al. is directed to preparation of high cetane number Diesel engine fuel by adding organic peroxides and/or organic hydroperoxides thereto. Farkas et al. "prefer to effect the oxidation in the presence of a basically reacting agent which will form slats with acids which are produced during the oxidation thus effectively removing said acids which as indicated hereinabove, appear to be catalysts for the decomposition of peroxides" (Farkas et al., col. 9 lines 30 to 36). reference describes neutralizing acids in hydrocarbon effluent from non-catalytic oxidation, but does not disclose or suggest a presence of any sulfur or nitrogen containing compounds.

The Schultz et al. and/or Farkas et al. references in combination with the EP reference do not disclose or suggest Applicants' novel process.

Examiner Nguyen avers that six different elements of Applicants' novel process would have been obvious to one having ordinary skill in the art at the time the invention was made (see pages 5 and 6 of Office communication mailed October 18, 2006). Applicants respectfully request Examiner Nguyen to keep in mind that most, perhaps all, patentable inventions consist essentially of known elements one or more of which may be critical in overcoming claim rejections under 35 U.S.C. § 103(a).

Claims 33 to 36 are in condition for allowance for the additional reasons that the references of record do not disclose or suggest Applicants' novel process that includes: partitioning by distillation a hydrotreated distillate to provide at least one low-boiling organic part consisting of a sulfur-lean, mono-aromatic-rich fraction collected below a temperature in the range from 260° C. to 300° C., and a high-boiling organic part consisting of a sulfur-rich, mono-aromatic-lean fraction;

contacting a gaseous source of dioxygen with at least a portion of the low-boiling organic part in a liquid reaction medium containing a particulate, heterogeneous oxygenation catalyst system; in combination with

contacting least a portion of the high-boiling organic part with an immiscible phase comprising at least one organic peracid or precursors of organic peracid in a

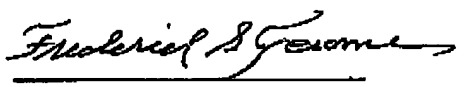
liquid reaction mixture maintained substantially free of catalytic active metals and/or active metal-containing compounds and under conditions suitable for oxidation of one or more of the sulfur-containing and/or nitrogen-containing organic compounds.

Base on the amendments submitted above, Applicants urge that Claims 31 to 38 inclusive, are in condition for allowance. Applicant respectfully requests Examiner Nguyen to pass subject application for allowance.

Do not hesitate to contact Frederick S. Jerome whose telephone number is (630) 832-7974 (FAX (630) 832-7976) if additional assistance is needed regarding this paper or earlier papers for Applicants.

Applicants and their undersigned Attorney appreciate Examiner's attention and consideration of this matter.

Respectfully submitted,



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